

How the System Wide Evaluation and Planning Tool (SWEPT) Can Support Air Traffic Management Decision-Making in the Eastern U.S.

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Agenda

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- Current Problems with the Rerouting of Aircraft
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What is SWEPT?

- The System Wide Evaluation and Planning Tool (SWEPT) is a Traffic Flow Management (TFM) decision support tool that is under development at NASA Ames
- SWEPT can be used for real-time decision-making or post-operations analysis at either a national or a regional level.
- The SWEPT trajectory prediction module computes the predicted demand at sectors, fixes and airports.
- Graphical displays are available in SWEPT, which quickly identify NAS resources that are over-utilized.

Recent System Delays 2004-2005

	Sept	Oct	Nov	Dec	Jan	Feb
Weather Delay						
Number of Delays	17,045	27,240	30,000	32,575	36,511	28,810
% of Total Operations	2.91%	4.47%	5.13%	5.37%	6.14%	5.28%
Delayed Minutes	1,014,871	1,370,615	1,858,324	2,313,183	2,472,483	1,742,556
% of Total Delayed Minutes	27.38%	28.65%	32.42%	28.05%	32.44%	31.85%
Non-Weather Delay						
Number of Delays	58,102	81,101	83,696	121,466	106,805	83,087
% of Total Operations	9.93%	13.29%	14.32%	20.02%	17.95%	15.24%
Delayed Minutes	2,691,936	3,413,089	3,873,577	5,934,501	5,148,561	3,728,385
% of Total Delayed Minutes	72.62%	71.35%	67.58%	71.95%	67.56%	68.15%

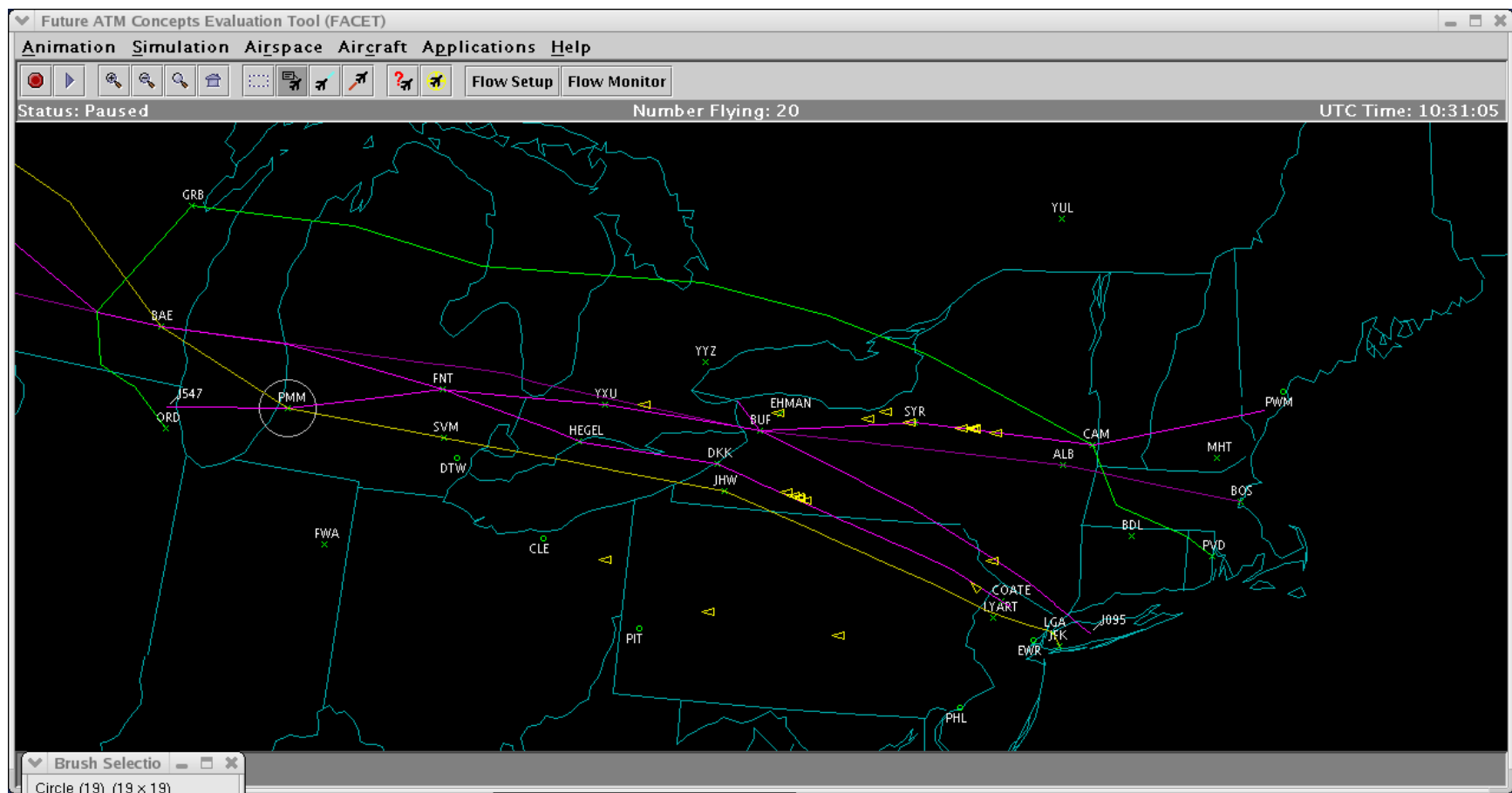
Sample Air Traffic Management Problems that SWEPT May Support in the Future

- International flights landing at U.S. airports transiting the Boston Air Route Traffic Control Center (ZBW) airspace
- Dulles (IAD) airport arrivals departing from the New York (ZNY) and Boston (ZBW) control areas.
- Westbound departure flows to the Chicago O'Hare (ORD), Chicago Midway (MDW), and Detroit Metropolitan (DTW) airports as well as over-flights destined for airports in the Minneapolis (ZMP), Denver (ZDV), Salt Lake (ZLC), Seattle (ZSE), and Oakland (ZOA) control areas.
- Delays out of the Atlanta Hartsfield International airport (ATL) to ORD, with over-flights departing from the Miami (ZMA) and Jacksonville (ZJX) center areas.
- Future airline hub operations at the Fort Lauderdale Airport (FLL) (arrivals and departures).
- ATL arrivals from the Northeast.
- Florida and Caribbean flights to and from the Northeast. (Canadian, ZBW, ZNY, and Washington (ZDC) effort

The Need for Rerouting Aircraft

- An airspace fix becoming saturated or unusable because of the volume of aircraft and/or severe weather.
- Securing releases for these aircraft from adjacent controlling sectors and facilities, and establishing appropriate reroutes for departing aircraft requires multiple, serial phone calls
 - These phone calls are ineffective to handle a heavy traffic volume or dynamic weather system with changing traffic flow demands.
- The unique proximity of major airports, air traffic facilities, and the coordination and dynamic management is required particularly in the Northeast Corridor of the United States.
 - A Northeast Corridor Rerouting Program is expected to make a major contribution to a successful solution to reduce delays in the Northeast Corridor (ZBW, ZNY, and ZDC areas).


Reroutes



Current Problems with the Rerouting of Aircraft

- Air Traffic, especially in the Northeast Corridor, requiring reroutes, cannot be rerouted expeditiously
- Taxi and departure line up sequence are not automatically available to all facilities
- Restrictions that include placeholder slots cause real capacity to go unused.

Aircraft Departure List

 Aircraft list for: DKK..PMM..ORD @ 1115

ACID	<input type="checkbox"/>	Original Route Selected Route	Alt	Delay	Rise Time
UAL667	<input type="checkbox"/>	LGA..COATE.J36.FNT.PMM4.ORD/0150	100	0	*1000
UAL1161	<input type="checkbox"/>	BDL..CTR..CAM..SYR.J63.EHMAN..YXU.J547.PMM.PMM4.ORD/0156	100	0	*1000
UAL635	<input type="checkbox"/>	BWR..COATE.J36.FNT.PMM4.ORD/0151	100	0	*1000
AAL301	<input type="checkbox"/>	LGA..COATE.J36.FNT.PMM4.ORD/0148	100	0	*1000
AAL1529	<input type="checkbox"/>	HPN..COATE.J36.FNT.PMM4.ORD/0155	100	0	*1000
EGF155	<input type="checkbox"/>	ALB..SYR.J63.EHMAN..YXU.J547.PMM.PMM4.ORD/0152	100	0	1008
EGF182	<input type="checkbox"/>	SYR.V483.DINES..EHMAN..YXU.J547.FNT.PMM4.ORD/0136	100	0	1025
BLR421	<input type="checkbox"/>	HPN..COATE.J36.FNT.PMM4.ORD/0149	100	0	*1000

Select All

Clear

Cancel All Reroutes

Select Reroute

Preview

Publish

Cancel

Current Problems Constraining Efficiency in the Rerouting of Aircraft

- Taxi and lineup status/sequence are not shared between facilities (Tower-TRACON-Center) expeditiously. ATM process
 - Is labor intensive and time consuming
 - Requires multiple phone calls
 - Requires manual calculation of release time windows
- Miles-in-Trail (MIT) restrictions include placeholder slots that are not used.
- Routes can not be changed expeditiously because of
 - Delays in selecting and coordinating reroutes cause towers to not receive reroute clearances in time to affect delays
 - Delay and reroute coordination require manual inter-facility coordination of flight schedules and departure clearances
- It is difficult to recover from a Severe Weather Avoidance Plan (SWAP) due to demand uncertainty
- No alternative to a Ground Delay is ever offered to the system customer.

Benefits and Goals in the Use of SWEPT for the Rerouting of Aircraft

- Dynamic situational awareness through wider and more timely distribution of flight data
- Reduced Ground Stops due to more effective sequencing of departures
- Automated structured flows that improve productivity and make a greater use of capacity and improve utilization of gaps in overhead streams. In particular, they:
 - help to eliminate static Minutes-in-Trail (MINIT) restrictions and
 - assist in reducing MIT restriction bottle necks at ARTCC exit fixes
- Optimal sequencing of departures into overhead streams/flows
- Optimal sequencing of international over-flights
- Reduction in Ground Delays/Stops, especially during Severe Weather
- ATCSCC will have the ability to allocate equitable delay distribution involving multiple airports

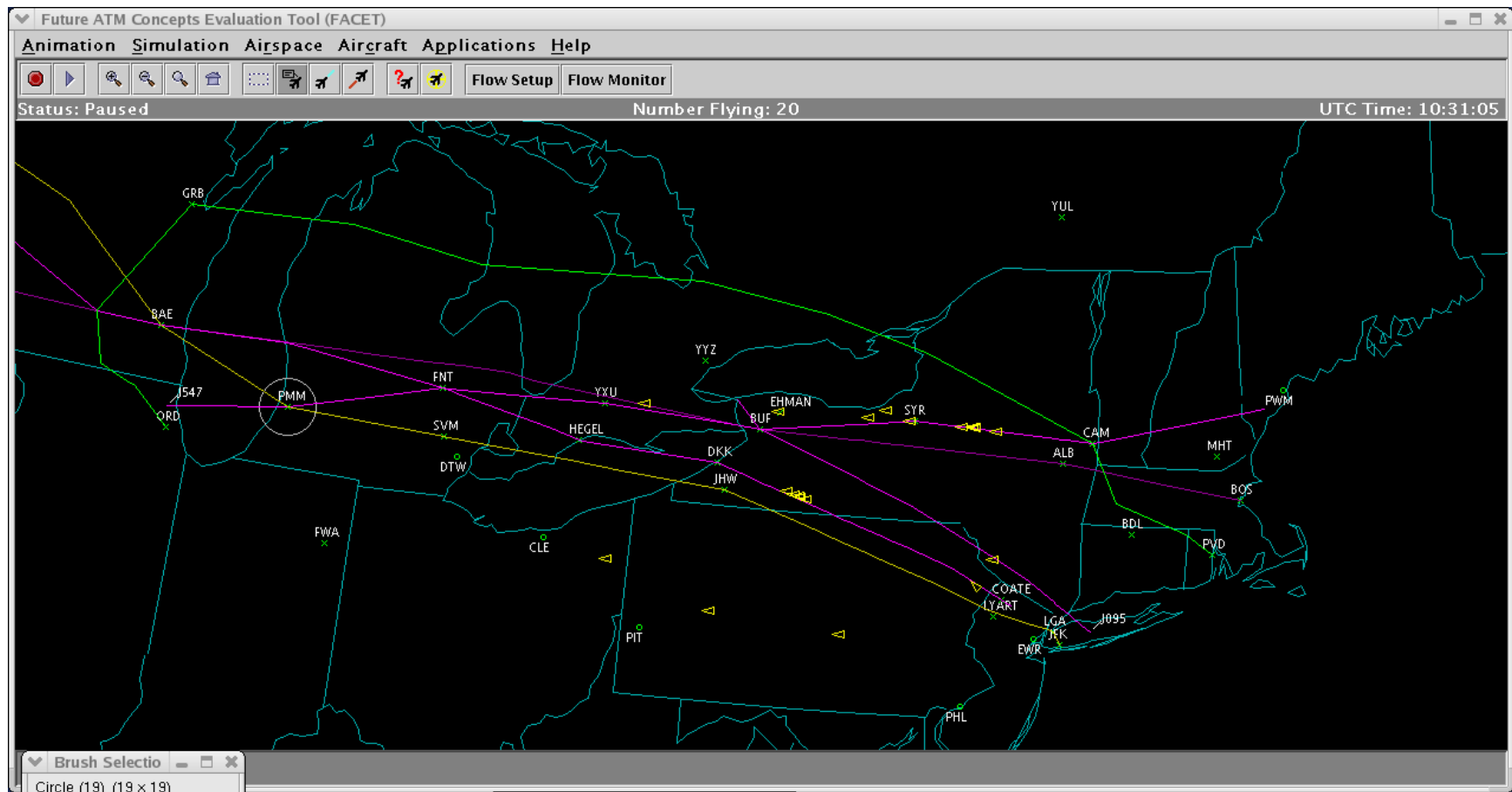
Requirements on SWEPT for Improving Multi-Center Reroute Operations

- Have the ability to communicate from center to center with an automated solution to flow aircraft on approved reroutes in the NAS
- Be able to identify all traffic utilizing the NAS and be able to integrate traffic departing underlying airports into the overhead streams in the Northeast Corridor
- Provide dynamic fix reroute adaptation capability.
- Have the capability of offering the customer a choice between taking a Ground Delay or accepting a reroute
- Have SWEPT account for air traffic flow variables such as aircraft speed, and wind
- Exploit the DSP capabilities for improved coordination between towers, TRACONS, and ARTCCs.

Sample Scenario on the Use of SWEPT to Support Decision-Making for Westbound Flows from ZNY and ZBW to ORD

- The PMM arrival fix for ORD gets overloaded by traffic departing from ZOB , ZBW, ZNY, YYZ/YUL and internal ZAU traffic via J94-547.
 - ZAU TMU personnel request that a 20 MIT constraint over PMM for ORD arrival traffic.
 - ZOB personnel in turn request a 30 MIT constraint over FNT (Flint) for ZBW traffic on jet routes J94 and J547 and a 10-30 MIT constraint over FNT for ZNY traffic on J36-J95
 - Causes Ground Delays for traffic departing from within the ZNY and ZBW areas.
- SWEPT will show
 - the expected delays and window departure times for aircraft leaving ZNY or ZBW for ORD.
 - the benefits of aircraft accepting a northern reroute from ZBW and (possibly) no delay.
- It is expected that aircraft pilots with less than a 15 minute delay will probably accept the delay rather than take the reroute if ORD is landing **west**.
 - On the other hand, if ORD is landing **east**, these same aircraft pilots would be expected to take the reroute rather than accept the delay
 - For aircraft pilots leaving ZBW with more than a 15 minute delay, it is expected that they may want to take the reroute whether or not ORD is landing **west or east**.

Reroutes



SWEPT Data Needs

- Accurate predictions of actual departure times.
 - SWEPT has assumed that the quality of departure time predictions available with the Departure Spacing Program will be available in the geographic areas of interest
 - In addition, it is expected that DSP will be used to hold departures on the ground or to implement a reroute once a MIT and/or reroute “game plan” has been agreed upon at a CDM teleconference.
 - Airborne rerouting in the Northeast corridor is not acceptable to Traffic Managers and Controllers due to the amount of traffic and the closeness of jet routes in the region. Any changes to filed flight plans are best performed on the ground and, preferably, before the aircraft taxis.

Plans for Maturing SWEPT so that it can be used in an Operational Environment

- The SWEPT model also needs to help the Traffic Management Coordinators (TMCs) implement
 - Ground Delay Programs
 - Ground Stops
- The SWEPT model needs to facilitate the human judgment by organizing details and presenting them in a meaningful way.

System Overview

